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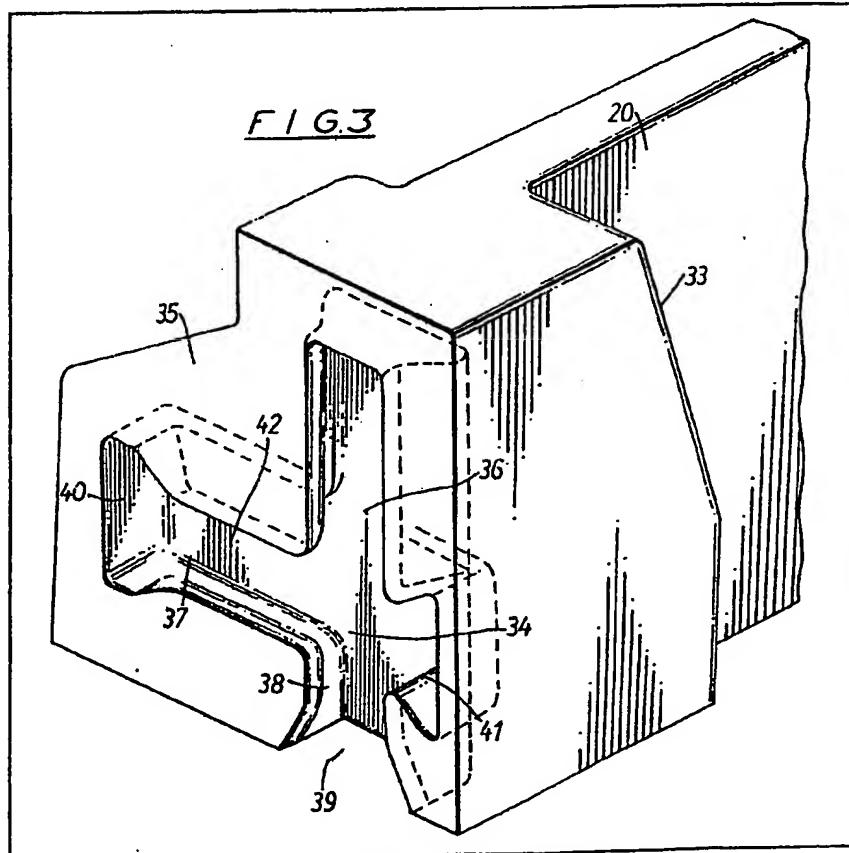
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(54) Methods of connecting together frame sections

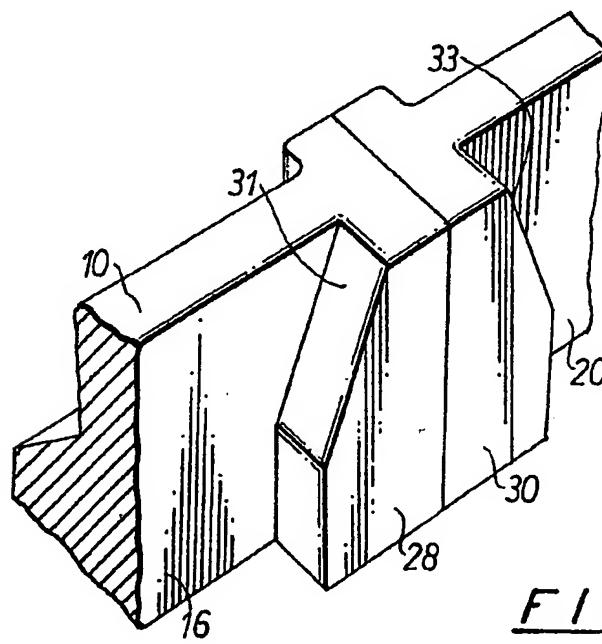
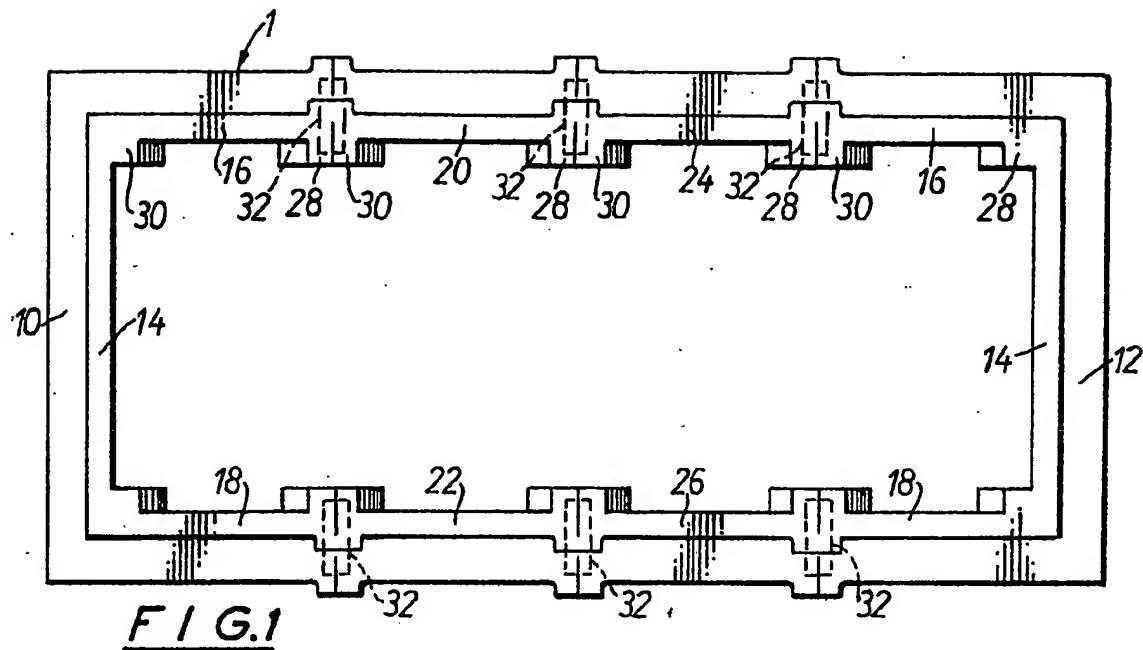
(57) The sections such as 20 of a frame for supporting at least one article of highway or carriageway "furniture" are connected together by holding the frame sections such as 20 in abutting relationship with preformed recesses 34 in the abutting surfaces 35 of adjacent sections opposite one another, and pouring molten metal into the mutually confronting recesses 34 of each joint by way of a respective pouring hole 39. The recesses 34 are so shaped that the metal filling the recesses 34 serves, when solidified, to prevent relative movement of the frame sections in all directions.



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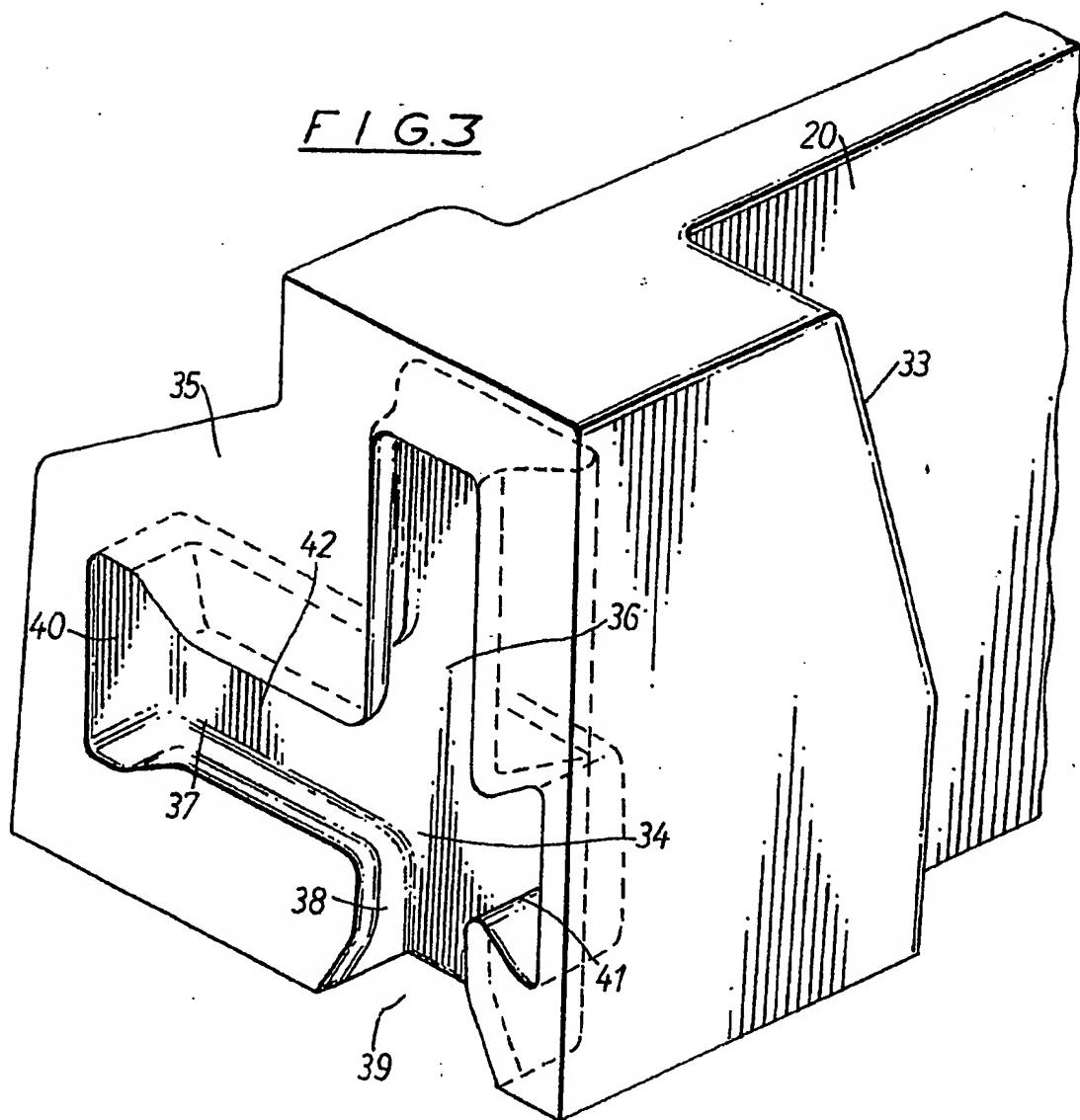
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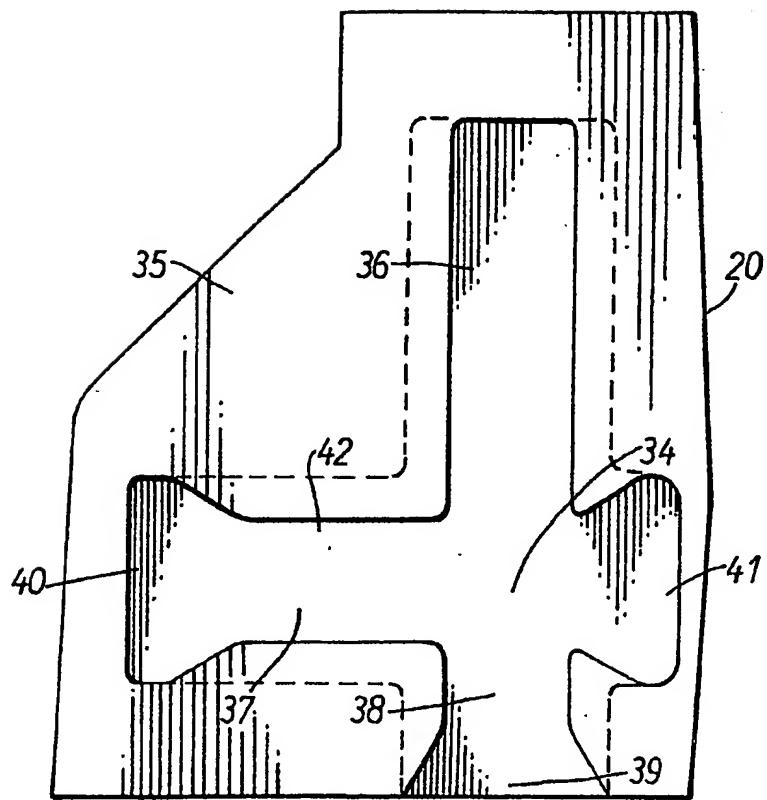
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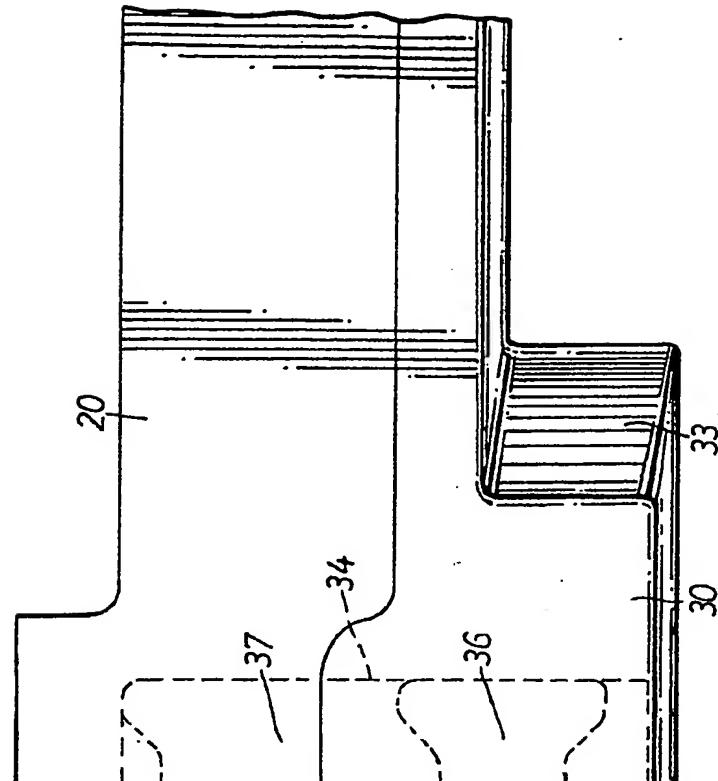
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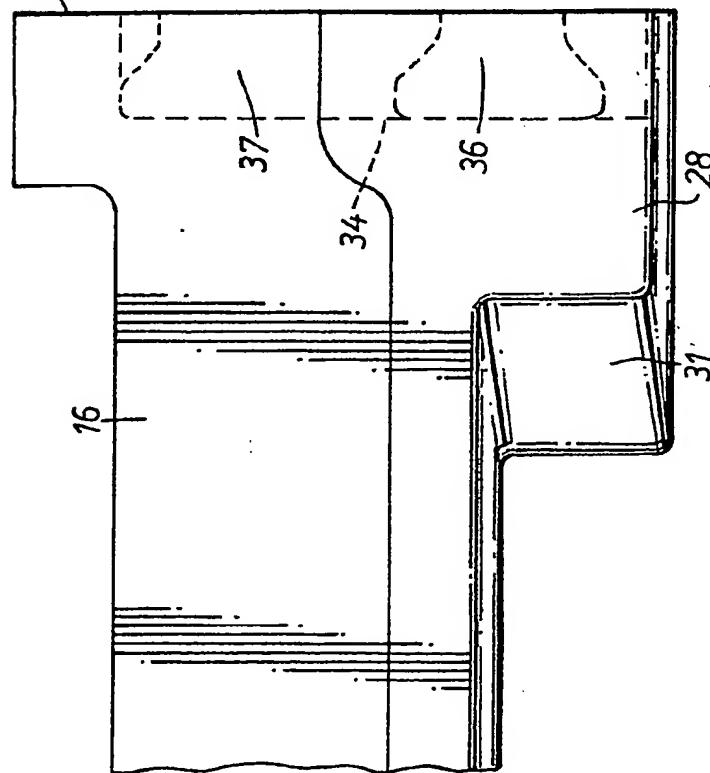
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**SPECIFICATION****Support frames and methods of connecting together frame sections**

5 This invention relates to frames for supporting articles of highway and carriageway "furniture" such as manhole covers, the frame comprising a plurality of sections which, when assembled 10 together, form a hollow structure of cross-section matching the cover or covers to be supported. The invention also concerns methods of connecting together the sections of such frames.

Patent Specification No. 2,013,301 A discloses 15 such a frame in which the frame sections are connected together by locking members engaging within confronting recesses in abutting surfaces of adjacent frame sections. The inner portions of the recesses, and the parts of the locking members 20 which fit within these portions, widen inwardly so as to prevent movement apart of the frame sections. However, the locking members and recesses must be manufactured to close tolerances, and considerable force may be required to introduce the locking 25 members into the recesses. Furthermore two pairs of recesses and two locking members must be provided at each joint to prevent relative movement of the frame sections in all directions.

It is an object of the invention to provide a means 30 of reliably connecting together the frame sections which requires only a single connection operation in respect of each joint and which obviates the need for close manufacturing tolerances.

According to the invention adjacent sections of the 35 frame have abutting surfaces with a recess formed in each abutting surface so as to confront a corresponding recess in the adjacent abutting surface, the two mutually confronting recesses in adjacent abutting surfaces being filled with metal which has been 40 introduced into the recesses in molten form by way of a pouring hole whilst holding the frame sections in abutting relationship, and the recesses being so shaped that the metal filling the recesses serves, when solidified, to prevent relative movement between 45 adjacent sections.

Thus, in order to connect together the sections of a frame, all that is necessary is to hold the frame sections in their required positions with the pre-formed recesses in the abutting surfaces of adjacent 50 sections disposed opposite one another, and to introduce molten metal into the mutually confronting recesses of each joint by way of a respective pouring hole.

At least part of each recess preferably includes an 55 inner portion which is wider than a portion of the recess intermediate the inner portion and the corresponding abutting surface, so as to lock the solidified metal within the recesses and prevent adjacent frame sections from being pulled apart. For example, at least part of each recess may taper in a direction towards the corresponding abutting surface.

In order to provide high resistance to relative movement of two adjacent abutting surfaces in two 60 mutually perpendicular directions parallel to these

surfaces, each recess may include two parts which are elongate tangentially to the corresponding abutting surface, which parts have mutually transverse longitudinal axes. These parts may be joined at their ends so as to form the shape of a letter "L" at the corresponding abutting surface.

Furthermore, in order to provide additional resistance to relative movement of two adjacent abutting surfaces in a predetermined direction parallel to 75 these surfaces, each recess may include at least one part having a first portion which is wider in a direction parallel to the corresponding abutting surface and perpendicular to said predetermined direction than is a second portion spaced from the 80 first portion along said predetermined direction. For example, at least one part of each recess may taper in a direction parallel to the corresponding surface.

In a preferred form of the invention, each recess comprises two parts in the form of a letter "L", each 85 of which tapers in a direction towards the corresponding abutting surface, one of said parts having ends which taper in opposite directions parallel to the corresponding abutting surface, and the other of said parts being provided with an extension which 90 extends beyond said one part to the pouring hole. The pouring hole may be disposed in a bottom surface of the frame.

The invention also provides a method of connecting together the sections of a frame for supporting at 95 least one article of highway or carriageway "furniture", comprising holding the frame sections in abutting relationship with preformed recesses in the abutting surfaces of adjacent sections opposite one another, pouring molten metal into the mutually 100 confronting recesses of each joint by way of a respective pouring hole, and allowing the molten metal to solidify within the recesses.

In order to ensure that gaps are not present 105 between abutting surfaces through which molten metal may pass, these surfaces are preferably accurately cast or machined so as to render them completely flat. The frame is preferably turned upside down during connection of the frame sections to enable molten metal to be poured into 110 pouring holes in a bottom surface of the frame.

In order that the invention may be more fully understood, a preferred embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

115 *Figure 1* is a plan view of the assembled frame;  
*Figure 2* is a perspective view of the joint between two adjacent sections of the frame;

*Figure 3* is a perspective view of part of a frame section showing a surface having a recess therein to be joined to an abutting surface of an adjacent frame section having a similar recess therein;

*Figure 4* is a view of the surface having the recess thereto from the front; and

*Figure 5* is an enlarged plan view showing parts of 125 two frame sections prior to bringing the frame sections together to form a joint.

Referring to *Figure 1*, the frame 1, which is intended to support a row of four covers (not shown), is formed by two end sections 10 and 12, each of which has an end portion 14 and two side

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- portions 16 and 18, and four intermediate sections 20, 22, 24 and 26. The joints between adjacent sections incorporate metal locking members 32 as shown in broken lines in Figure 1.
- 5 Figure 2 shows the joint between the end section 10 and the intermediate section 20 from which it will be seen that inwardly extending projections 28 and 30 are provided on the abutting ends of the sections, and these projections define sloping surfaces 31 and 10 33 for engagement with corresponding formations on the covers to be supported. Similar inwardly extending projections are also provided at the corners of the end sections 10 and 12 as shown in Figure 1.
- 15 As shown in Figures 3 to 5 a respective recess 34 is formed in each of the abutting surfaces 35 of the joints between adjacent frame sections. Each recess 34 comprises two parts 36 and 37 which are elongate tangentially to the abutting surface 35 and which are 20 joined at their ends to form the shape of a letter "L" at the abutting surface 35. The part 36 is provided with an extension 38 which extends beyond the part 37 and forms a pouring hole 39 in the bottom surface of the frame. The part 37 of the recess 34 has two 25 widened ends 40 and 41 which taper in opposite directions parallel to the abutting surface 35 towards an intermediate waisted portion 42. Both the waisted portion 42 and the part 37 are wider at the bottom of the recess 34 than at the abutting surface 35 and 30 taper from the bottom towards the abutting surface 35.
- In order to join the frame sections 10, 12, 20, 22, 24 and 26 together, these sections are held upside down in the intended configuration and with adjacent abutting surfaces 35 in contact with their recesses 34 confronting one another, and molten aluminium alloy is poured onto the pouring holes 39 in order to fill the mutually confronting recesses 34 of each joint. The molten metal is then allowed to 40 solidify and, when solidified, forms locking members 32 which are of such a shape and strength as to prevent relative movement of the frame sections in all directions even under heavy loads.
- 45 CLAIMS
1. A frame for supporting at least one article of highway or carriageway "furniture", comprising a plurality of sections which, when assembled 50 together, form a hollow structure of cross-section matching the article or articles to be supported, wherein adjacent sections of the frame have abutting surfaces with a recess formed in each abutting surface so as to confront a corresponding recess in 55 the adjacent abutting surface, the two mutually confronting recesses in adjacent abutting surfaces being filled with metal which has been introduced into the recesses in molten form by way of a pouring hole whilst holding the frame sections in abutting 60 relationship, and the recesses being so shaped that the metal filling the recesses serves, when solidified, to prevent relative movement between adjacent sections.
  2. A frame according to claim 1, wherein at least 65 part of each recess includes an inner portion which is

- wider than a portion of the recess intermediate the inner portion and the corresponding abutting surface.
3. A frame according to claim 2, wherein at least 70 part of each recess tapers in a direction towards the corresponding abutting surface.
  4. A frame according to claim 1, 2 or 3, wherein each recess includes two parts which are elongate tangentially to the corresponding abutting surface, 75 which parts have mutually transverse longitudinal axes.
  5. A frame according to claim 3, wherein the two parts are joined at their ends so as to form the shape of a letter "L" at the corresponding abutting surface.
  - 80 6. A frame according to any preceding claim, wherein each recess includes at least one part having a first portion which is wider in a direction parallel to the corresponding abutting surface, and perpendicular to a predetermined direction also parallel to said surface, than is a second portion spaced from the first portion along said predetermined direction.
  7. A frame according to claim 6, wherein at least one part of each recess tapers in a direction parallel 90 to the corresponding abutting surface.
  8. A frame according to claim 1, wherein each recess comprises two parts in the form of a letter "L", each of which tapers in a direction towards the corresponding abutting surface, one of said parts 95 having ends which taper in opposite directions parallel to the corresponding abutting surface, and the other of said parts being provided with an extension which extends beyond said one part to the pouring hole.
  - 100 9. A frame according to any preceding claim, wherein the pouring hole is disposed in a bottom surface of the frame.
  10. A method of connecting together the sections of a frame for supporting at least one article of 105 highway or carriageway "furniture", comprising holding the frame sections in abutting relationship with preformed recesses in the abutting surfaces of adjacent sections opposite one another, pouring molten metal into the mutually confronting recesses 110 of each joint by way of a respective pouring hole, and allowing the molten metal to solidify within the recesses.
  11. A method according to claim 10, wherein the frame is turned upside down to enable the molten 115 metal to be poured into pouring holes in a bottom surface of the frame.
  12. A frame for supporting at least one article of highway and carriageway "furniture", substantially as hereinbefore described with reference to the accompanying drawings.
  13. A method of connecting together the sections of a frame for supporting at least one article of highway or carriageway "furniture", substantially hereinbefore described with reference to the accompanying drawings.